

IPM for Rats in Schools

Adapted from Daar et al., 1997

Rats damage food, clothing, documents, and structures through gnawing, urination, defecation, and nesting activities. The damage to food from contamination is probably ten times greater than the damage by direct feeding. Feces and urine raise the humidity of enclosed spaces, promote wood deterioration, and provide a medium for proliferation of microorganisms (Frantz, 1988). Rats cause fires by chewing through the insulation on electrical wires, and they are involved in spreading human pathogens, such as bubonic plague.

The best approach to rat problems combines careful inspection, regular monitoring, sanitation, garbage management, rat proofing, trapping, and, if necessary, baiting with toxicants. Unless the conditions that attracted rats in the first place are changed, new rats often move into the habitat vacated by the dead ones, and the cycle will continue.

Although setting out poison baits is the common response to rat problems, this tactic has been overused, and some rats are no longer affected by the poison. Even when baits remain effective, poisoned rats frequently die in inaccessible places where their decomposing bodies create unpleasant odors and provide food for pest insects such as flesh flies and carpet beetles. Moreover, on school grounds, there is always a risk that children or pet animals will inadvertently encounter the bait.

Biology

It is important to identify which rat species is present. **Table 7.2-1** shows the differences between

the Norway rat and the roof rat. After trapping a rat, you can use information from this table to identify it.

The two most common pest rat species in California, both introduced from Europe, are the Norway rat, *Rattus norvegicus*, and the roof rat, *Rattus rattus*. Rats can reproduce year round in subtropical climates. In cooler climates, populations peak on spring and autumn. Gestation period is 20 to 25 days, with the pups weaned at around 30 days. The average litter size is 5 to 12, with up to nine litters per year, depending on food availability. Sexual maturity for the Norway rat is 75 to 90 days and 68 to 90 days for the roof rat. The life span of rats in the wild is less than one year.

The Norway rat, considered the most important pest rat in California, is also known as the brown, wharf, house, gray, or sewer rat. It occurs in every state. The roof rat, also known as the ship, black, or Alexandrine rat, occurs mainly along the coastal U.S., including the Pacific coast states, the Gulf states, and the southern and Atlantic states.

Characteristics of rats that can have an impact on management include the following:

- They will feed on a wide variety of materials (see **Table 7.2-2** for more specific information).
- Rats usually search for food between dusk and dawn, but when hungry or living under crowded conditions, may be seen in the daylight.
- They require water daily, unless food items are succulent.

Table 7.2-1: Difference Between the Norway Rat and the Roof Rat

	Norway Rat	Roof Rat
Scientific name	<i>Rattus norvegicus</i>	<i>Rattus rattus</i>
Other common names	brown, wharf or sewer rat	black, ship or house rat
Adult weight	3 to 21 ounces	3 to 12 ounces
Snout	blunt	pointed
Ears	small & thick with short hairs	large & thin without hair
Tail coloration	dark above, pale underneath	all dark
Fur	brown with black; shaggy	light brown, gray to black; smooth
Droppings	capsule-shaped, pointed	pointed & curved
Food requirement	about 1 ounce/day	1 ounce or less/day
Water source	free water*	free water*
Climbing ability	can climb	active climber
Nest locations	mainly in burrows	walls, attics, trees
Swimming ability	excellent	can swim

*Water present by itself and not simply a constituent of the food eaten by the rat. Free water unnecessary when feeding on succulent foods, but needed if diet is dry and/or high in protein.

Sources: Frantz & Davis, 1991; Olkowski et al., 1991

**Table 7.2-2: Nesting and Eating Habits
of the Norway Rat and the Roof Rat**

	Norway Rat	Roof Rat
Nesting Sites Outdoors	In the ground, in burrows that are less than 18 inches deep and less than 3 feet long; burrow openings are 2 to 4 inches in diameter; burrow system can be quite complex and interconnected; in unused sewers or storm drains.	Usually above ground: in trees, especially untrimmed palm trees; in dense, overgrown vegetation, especially Algerian ivy (<i>Hedera canariensis</i>); and in piles of wood and debris in the ground if there are few suitable above-ground sites and there are no Norway rats nesting in the area in unused sewers or storm drains.
Nesting Sites Indoors	Usually in the lower floors of the building; in wall voids and crawl spaces; in storage rooms under pallets or equipment; behind seldom-used stored materials at the corners and backs of rooms; in any cluttered area that is little used.	Usually in the upper part of the building; in the attic; in ceiling and attic voids; can also nest in the lower floors of a building.
Eating Habits	More likely to eat garbage than roof rats. prefer foods that are high in protein, such as fish, meat, nuts, grains, pet food insects.	Prefer fresh plant material, such as nuts and seeds, fruit and vegetables, and tree bark. Sometimes eat garbage and meat.

Sources: Meehan, 1984 and Ingles, 1965

- Rats can travel several hundred feet from their nests in search of food, depending on the relationship of food to nesting resources.
- They prefer traveling along edges, e.g., the edge of the floor next to the wall, along the outside or inside of a foundation. They also travel along pipes, rafters, and for roof rats, overhead utility lines.
- They are wary of crossing open spaces that provide no cover.
- Rats have poor visual acuity, but are quite sensitive to patterns and contrasts.
- They have acute senses of smell, taste, touch, and hearing; navigate using their whiskers and guard hairs.
- They tend to be extremely wary (though temporarily) of new objects in their environment.

In general, Norway rats build their nests in underground burrows or in ground-level areas in buildings while roof rats prefer living in elevated areas. Table 7.2-2 provides more specific information.

Rats have amazing physical abilities. Understanding what they can and cannot do is very important when planning ways to prevent rat problems or to reduce the number of rats present.

Detection and Monitoring

Management of rats always begins with a systematic survey and evaluation of the site. Make a thorough inspection to find as many of the active infestations as possible. At the same time note all possible harborage sites, sources of food and water, and holes that provide access to the building. **Box 7.2-1** details the signs of rat infestation, and **Boxes 7.2-2** and **7.2-3** summarize the areas to inspect inside and outdoors. Make detailed notes about problem areas on a map of the building. Do not

neglect to inspect any outbuildings on the property.

Effective monitoring involves each of the following steps. Make a site plan of the school with separate drawings of each floor so you can accurately record information. Lightly dust smooth surfaces near suspected harborage, runs, or entry points with unscented talcum powder or powdered chalk to gain further information. Footprints and draglines (made by tails) across powdered surfaces indicate rat traffic. The powder can also be dusted onto a heavy, smooth material such as a piece of floor tile that can be moved around. Holding a flashlight at a low angle helps to illuminate tracks on dusty surfaces.

Inspect at night with a strong flashlight. Look for movement and listen for squeaking, scrambling, and gnawing sounds. Vacuum up fecal pellets and gnawed wood shavings and remove any nests. Re-inspect for new rat signs in a day or two.

Place a piece of gray paper or cardboard in dark or hard-to-reach areas and inspect them later for fecal pellets. Temporarily close suspected rat burrows or openings with soil, crumpled paper, aluminum foil, or sawdust. Inspect 24 hours later to see if the holes have been opened or the paper chewed or moved.

Monitoring Blocks/Monitoring Stations

Non-toxic, food attractant blocks are commercially available for monitoring rats. You can also use bait stations filled with non-toxic baits such as rabbit food or grains. These monitoring blocks or stations can be placed anywhere indoors or out to locate or monitor a rat population simply by noting whether animals have fed on the bait. Monitoring blocks or stations can also help you gauge the effectiveness of your treatment efforts. The blocks or bait stations should be wired, staked, or glued down with caulk so they cannot be dragged away. Mark the blocks or stations clearly with a tag alerting people that a

Box 7.2-1

Live or Dead Rats

Seeing live rats is the most obvious and certain sign of their presence. Seeing live rats in the daytime usually means there is a heavy infestation, that their harborage has been disturbed, or that new rats are moving into the area and haven't found any harborage yet. A freshly dead rat is a sign of infestation, but this is not necessarily true with an old, dried body, which may merely indicate a previous infestation.

Droppings

- The largest number of droppings will be in feeding areas and near harborage.
- Rat droppings may be as large as 3/4 inch long and 1/4 inch in diameter.
- Fresh droppings are moist, soft, black or nearly black, and they glisten or look wet. After a few days to a week, the droppings dry, become hard, and appear dull rather than shiny. In warm, dry atmospheres, the droppings can lose their shine after only a few hours. After a few weeks, rat droppings become gray, dusty and crumbly.
- If very old droppings are moistened, they may look like new ones, but they will still be crumbly instead of soft.
- Sometimes lizard or bat droppings can be confused with rats droppings, but both lizard and bat droppings contain many insect fragments that can easily be seen when the droppings are crushed.
- To monitor for current rat activity, remove the droppings so that fresh droppings are apparent during future inspections.

Damage to Goods and Structures

- Rats gnaw to get at food in packaging or containers and to obtain nesting material.
- When rats gnaw, their front teeth leave two parallel marks, about 1/8 inch across.
- Gnaw marks on doors or ledges, in corners, in wall material, or on stored materials as well as bits of gnawed wood, paper, cloth or packaging, are good indications of rat presence.
- Rats can gnaw through rusty sheet metal and sheet aluminum.

Grease Marks or Rub Marks

These marks on beams, rafters, walls, pipes, and other fixtures are the result of oil and dirt rubbing off rats' fur along frequently traveled routes.

Runs or Burrows

These may be found outside along foundations, walls, or fences or under bushes or debris. Runs will look like tiny paths and burrows are open holes.

Tracks

Footprints and long, thin marks indicating a tail being dragged or rested can easily be seen on dusty surfaces, in mud, or in snow.

Noises

As rats gnaw, claw, fight, and scramble around inside walls they make noises. These are particularly audible at night when they are most active. A stethoscope may be used to pinpoint the activity. Note that squirrels and other animals can make similar noises, so you should confirm rat presence with other signs.

Urine

Rat urine will fluoresce blue-white under ultraviolet light, but many other substances also fluoresce, so recognizing rat urine takes skill.

non-toxic, rat monitoring program is underway.

Number each block or station and note its location on your map. In two to seven days, check for signs of rat feeding and record the amount on a monitoring form.

The following are some of the best locations to place monitoring blocks:

- Food storage areas.
- Kitchens-in closets and food storage areas.
- Locker rooms, break rooms, and teacher's lounges.
- Attics.
- Basements.
- Under and behind cabinets, appliances, computers, and electrical boxes.
- In storage sheds, especially any containing grass seed or bird seed.
- Outdoors in dense vegetation and along buildings and fences.

Management Options

Initially, concentrate control efforts in the high-risk/high-priority areas, such as the kitchen, the cafeteria, locker rooms, and perhaps various storage rooms. Your inspection will reveal the precise areas you must concentrate on in your own school. After you have improved sanitation in these areas, worked on rat exclusion, and trapped most of the offending animals, move on to the other areas you noted in your inspection. You need not tackle the entire school at once.

Habitat Modification and Sanitation

It is very important to change the physical environment that is supporting rats. As mentioned before,

if rats are killed but habitat and food are still available, it is very likely that new rats will move in to replace the dead ones.

Reducing Food Availability

Store foods such as grains, pet foods or snacks in metal, glass, or heavy plastic containers with tight-fitting lids. Food stored in classrooms or teachers' lounges should be in tightly closed containers. Do not leave food out overnight. Do not allow students to store food in their lockers overnight unless it is in rat-proof containers. Explaining to them why this is important will help with compliance.

Store fresh fruits and vegetables in refrigerators or in open-air coolers that are screened with 1/4 inch, heavy wire mesh. Store bags of grass seed, dry pet food, and other similar items in rat-proof containers, or at the very least, inspect them frequently for any signs of chewing. Promptly clean up any spilled birdseed around feeders.

Limiting Areas for Eating

If you expect to contain and limit pest problems (cockroaches and ants as well as rats), it is very important to designate appropriate areas for eating and to enforce these rules. The fewer designated areas, the easier it will be to limit the pests.

Managing Garbage Properly

In most areas, garbage is the main source of food for rats. An electric garbage disposal unit in the sink can make rat problems worse by providing them with food in the sewer system. Proper disposal of organic garbage (food waste, garden waste, pet waste) is essential.

All food waste from the kitchen, cafeteria, and other areas should be separated from other garbage, drained so it will be as dry as possible, and then stored in sealed plastic bags. These bags must be

Box 7.2-2

How to Conduct a Rat Inspection Inside

1. Begin in the basement or substructure. Remember that you are trying to find as many areas as you can that might provide harborage, food, water, or access to the building.
2. Make detailed notes on your schematic of the building.
3. Try to locate all entry points and nesting areas. "Starter holes" for rats to enlarge can be openings as small as 1/4-inch in diameter in walls, around pipe entries, sewer outlets, under doors, etc. Unscreened sewer outlets and even toilets can give rats access to buildings. Nests are often composed of things like shredded paper, pieces of plastic, and bits of fabric gathered together into a 8 to 12 inch diameter mass. If you find clothing or paper that looks torn or shredded but doesn't look like a nest, you will most likely find the nest nearby.
4. Look for water leaks and rooms where water condenses on the walls.
5. Always be on the lookout for piles of trash, clutter, or other debris.
6. Note where the custodians, teachers, and students take their breaks or eat lunch. These areas can present a sanitation problem.
7. Rats like to follow edges; inspect these areas for feces, rub marks, urine, or other indications of activity.
8. Move to the main floors of the building and inspect locker rooms, home economics rooms, art rooms, childcare areas, lower-grade areas, cafeteria, kitchen, and teachers' lounge. Even science rooms can have food for rats.
9. Continue into the attic to look for holes, nests, feces, and rub marks.

Adapted from Harmon, 1995

Box 7.2-3

How to Conduct a Rat Inspection Outside

1. Try to identify as many of the areas as possible that provide rats harborage, food, water, and access to the building.
2. Make detailed notes on your map of the exterior of the building and the school grounds.
3. Take note of how garbage is dealt with, what condition dumpsters and garbage cans are in, and whether rats have easy access to garbage.
4. Check doorways for gaps or holes and note windows without screens or glass.
5. Look for other openings in the structure-holes, vents without screens, holes around plumbing, and electrical wire entry points.
6. Note any power lines running into the upper portions of buildings and any trees which are brushing up against the structure; these give rats access to the roof.
7. Note any bird or bat problems because rats may not be far behind. Rats will feed on bird eggs, chicks, and young bats.
8. What kind of vegetation is growing near the building? Does it give rats cover for runways or nesting sites? Are there any fruit- or nut-bearing trees?
9. Inspect all planters, wood waste piles, portable storage containers, and outbuildings. Are there signs of rat infestation in or around any of these areas?
10. Take into account any field or lot which may be next door, as well as any supermarket or fast food establishment that may attract rats. Rats that start to invade the school may be an overflow from adjoining properties. If a vacant building next door to a school is going to be renovated or an empty field or lot prepared for construction, the rat population will be displaced to the surrounding areas.
11. Check for irrigation leaks and any standing water such as irrigation or drainage ditches, stagnant pools, ornamental ponds, and fountains.
12. On the roof, check air conditioning units that might provide water and harborage for rats.

Adapted from Harmon, 1995

placed in rat-proof containers at the end of each day because plastic bags are not rat-proof.

In food preparation areas, thoroughly rinse all cans, bottles, and plastic containers before recycling or discarding. Make sure garbage can and outdoor trash container (e.g., Dumpsters(tm)) lids seal tightly when closed, and remain closed when not in use, especially at night. Repair or replace garbage cans with holes or with lids that do not close tightly. Use stretchy fasteners over garbage can lids, if necessary.

Clean garbage cans and outdoor trash containers frequently to prevent the build-up of food waste. Dirty garbage cans not only attract pests, but also repel people who want to use the garbage cans so that trash ends up outside the can. Use a high-pressure stream of water or a brush and soapy water, if necessary. If possible, outdoor trash containers should be fitted with drains so dirty water can be drained. The plug should be snugly in place, except when hosing out the outdoor trash container; otherwise, rats can enter the container and it becomes a huge feeding station. Another option is to require the refuse company to clean the container or replace it with a clean one more frequently.

Do not store extra garbage in cardboard, plastic, or paper outside the garbage cans because they can be torn open by rats, dogs, raccoons, or other animals. Inspect outdoor trash receptacles at the end of the day, and pick up any wastes lying on the ground. Garbage cans on the school grounds should have removable, domed tops with vertical, spring-loaded swinging doors. Line these cans with plastic bags that can be tightly sealed and emptied into rat-proof garbage containers every evening. Inform students, teachers, and staff of the importance of placing garbage inside the proper containers.

Pick up cat and dog feces daily (rats will feed on these). Shovel, rake, or sweep up fallen fruit, nuts, and similar foods that may be feeding rats in the schoolyard. Dispose of in rat-proof garbage containers. Sometimes it may be necessary to strip trees of their fruits or nuts to get a rat problem under control. Store excess garden produce away from rats or dispose of it in rat-proof garbage containers.

Debris and Clutter

Clean up and organize storage rooms to eliminate as much clutter as possible. It's harder to detect rat presence in such rooms and the clutter is attractive harborage. Outside, remove debris heaps, wood piles, or construction debris.

Water

Freestanding water in stagnant pools, ditches, ornamental pools, or fountains can provide rats with their daily ration of water. Drain or eliminate these sources where possible. Fountains and ornamental pools will pose a problem, but during severe rat infestations, they may need to be temporarily drained.

Fix all leaking pipes, faucets, or broken irrigation systems. Eliminate condensation in places like boiler rooms.

Removing Vegetation

Trim trees, vines, bushes, grass, and weeds at least 12 to 18 inches from all buildings to decrease cover for rat runways and prevent hidden access to buildings. Break up dense plantings with pathways, stretches of lawn, or very low groundcover. Rats don't like to move across areas where they can be easily seen. Avoid large plantings of a single groundcover that could allow rats to run for long distances without being seen. Thin out dense bushes to reduce rat habitat.

Avoid planting date palms or Algerian ivy (*Hedera canariensis*) on the school grounds because rats can live in and feed on these plants.

Exclusion

Exclusion must be the basis of any reliable management program. Rat proofing will take time and should begin simultaneously with trapping and/or poison baiting. The following procedures are recommended:

Large Openings in the Exterior of the Structure

Seal openings larger than three inches in diameter with 1/4-inch hardware cloth, 19-gauge or thicker sheet metal, plaster, or mortar. Make supports or frames for the screen and make sure they are secured solidly to the building. If maintenance staff needs access to the opening, install a lockable door with a heavy-duty spring hinge that will automatically close the door if someone forgets.

Look for openings in the building not only in the first three feet above the ground, but also at the roof line, in the eaves, and in attic and roof vents. Make sure all vents are screened with 1/4-inch hardware cloth and that existing screen is not ripped. Cover vent pipes with a square of 1/4-inch hardware cloth bent around the pipe and secured with a wire.

Small Openings in the Structure, Inside or Out

Depending on the material in which you find these openings, holes as small as 3/16 inch in diameter should be sealed. These holes are very important and are often difficult to find. If the holes are in materials that rats can gnaw, they can enlarge these holes until they can eventually squeeze through them. Seal small holes with steel or copper wool (copper will not rust) or with caulk.

Check for gaps around exterior doors and seal with weather stripping. Metal kick plates can be used to prevent rat entry. Use raised metal doorsills when necessary. Some doors have vents or louvers in them as part of the ventilation system. It may be necessary to screen these. Sometimes pipes have been installed through the vents or louvers; make sure to seal any gaps around the pipes. Check areas where pipes and wiring enter buildings and close any gaps with caulk or with steel or copper wool.

Air Conditioners

These units can provide rats with water, harborage, and access to the structure. Make sure each unit is well sealed, especially those on the roof.

Sewer Pipes

Repair broken sewer pipes. Rats can dig into broken sewer lines and swim up the trap in a toilet to get into a building. Toilet drains can be rat-proofed by feeding the pipe from the toilet bowl into a pipe section of larger diameter (Frantz and Davis, 1991).

Drains

Cap the drains in basement floors so rats cannot enter through them. Install a brass drain cover or a perforated metal cap held in place by a hinge so it can be opened for cleaning. Make sure the un-hinged type of cover is threaded so it screws in place; otherwise, a rat can push it open. Place 1/4-inch galvanized hardware cloth under existing drain covers with holes larger than 1/2 inch.

Installing Barriers

Make rat-proof barriers to separate landscaping from the foundations of buildings by digging a small trench 8 to 12 inches wide, 8 inches deep, and as long as the building. Fill this with pea gravel.

Rats dislike burrowing in loose gravel so will be discouraged from trying to penetrate the foundation.

Barriers should be placed between and within walls to prevent rat travel. An open space between floor joists gives rats free access to wall voids. Wood 2_ x 4_ stops are sometimes used on upper floors, but an incombustible material should be employed on lower floors. In old buildings, galvanized sheet metal can be cut to fit and nailed between studs, joists, floor, and sill. In new construction, incombustible stops of a good grade of cement are recommended.

Pallets containing stored food and paper supplies can be rat-proofed by elevating the pallet on 12-inch cinder blocks, then covering the pallet with a layer of sheet metal so that the edges of the sheet metal extend four to six inches beyond the edges of the pallet. The edges should then be bent down toward the floor at a 45° angle.

Population Reduction: Trapping

Many schools have concerns about the ethical implications of killing rats slowly by trapping. Snap traps are probably the most humane in that regard because they kill the animals swiftly. These concerns for the animals can be turned into motivation for habitat modification and other strategies that exclude rats and eliminate their food supply, thus reducing the numbers that have to be directly killed. Be sure to inspect the traps daily to remove and humanely kill any rats that have been caught.

Killing trapped rats

The American Veterinary Medical Association states that the only acceptable methods of euthanasia for small rats are decapitation and cervical dislocation. For small rats caught on glue boards this means taking a sturdy rod or stick to make a sharp blow to

the base of the skull. Drowning is considered inhumane so is not regarded as euthanasia.

Tips for a successful trapping program

- Set traps in the correct locations, bait properly, and inspect frequently-sometimes this will mean daily.
- Use the map of the building and/or grounds to record the precise location of each trap and the date it was set. This record keeping is the key to preventing lost and forgotten traps. If dead and decomposing rats are left in the traps, the results can be very unpleasant.
- When handling traps, always wear gloves for protection from diseases.
- Rats will avoid traps for a few hours to several days after initial placement. “Pre-baiting” traps for rats (see below under Baits) can improve catches.
- If catches are poor, try moving the traps to new locations.
- When most of the rats have been trapped, it can be hard to catch the last few because they may have become trap-shy and will avoid the traps. In such cases, the traps can be removed for a week, and then set in new locations using the pre-baiting method described below. You can also leave out food in shallow pans until the rats readily eat it, and then camouflage the trap by burying it under the food in the pan.

Trap choices

Rat traps fall into three general categories: snap traps, live traps, and glue boards. The information below will help you decide where to best use each of the traps.

Snap Traps. These traps are widely available and can be made more effective by expanding the trigger so that it can be tripped by a rat simply running over the trap. Do not place them where human toes might accidentally get caught, unless the traps are protected inside a bait station (see below). These traps work well in dusty places, but do not use a snap trap in an area with standing water or high humidity because the mechanism will rust and the trap will be useless.

Live Capture Traps. Live traps are available for rats, but the rats must be killed once they are trapped.

Glue Boards. These traps are covered with a sticky material that will catch small rats. Glue boards provide the advantage of catching and retaining rat hairs, droppings, and ectoparasites coming from the trapped animal. Glue board traps should be inspected daily in order to prevent unnecessary suffering by the trapped animals.

If glue boards are used in areas where they might fall and stick to something, secure the traps with a nail or wire. Boards should always be secured when you are trapping rats so that if the rats are only partially caught they cannot drag the traps away. Baiting glue boards is not necessary but bait will improve the chances of success.

Trap Placement

Check the monitoring map to locate active rat holes, and set traps along walls or other runways leading to the holes. Other good trap locations include areas near droppings, gnawing marks, or other signs of rat damage; under and behind objects likely to harbor rats in dark corners; and along rafters or other protected areas where rats are likely to travel. Move objects around to funnel rats into the traps.

Set traps at right angles to the wall, with the trigger facing the wall. Place traps flush with the wall so that rats traveling along the edge of the wall will encounter the traps. Two traps, side by side with their triggers facing the wall, can increase the chances of success. Alternatively, the two traps can be placed parallel to the wall, back to back with their triggers facing away from each other. Three traps in a row will make it difficult for a rat to jump over the traps without being caught.

Traps can also be nailed to a wall or rafter or wired to a pipe. Make sure the trigger side of the trap is projecting into the rats' runway. When trapping rats with snap traps, it may be useful to secure the trap so that if a rat is only partially caught, it cannot drag the trap away to an inaccessible area.

A trap can be camouflaged by sinking it just below ground level on dirt surfaces. This is done by positioning the trap and then completely covering it with a fine layer of sand or sawdust. Traps can also be set in shallow pans filled with sawdust, grain, or meal. It may be necessary to place a small piece of cloth over the trigger to keep it from jamming.

Baiting the Traps

Baits for Norway rats include pieces of hot dog, bacon, liver, peanut butter, or nutmeats. Suggested baits for roof rats include nuts, dried fruits, or fresh fruits such as bananas or apples. You can also try other baits such as candy, marshmallows, raisins, or peanut butter mixed with rolled oats or bacon grease. Many of these baits don't last long because they dry up or become rancid. If rats are feeding on other foods, try them as baits also.

To catch rats, you will probably have to "pre-bait" the traps. Place the traps out with bait but do not set the traps. Check them daily to see if the bait has been taken, and move them to a new location if the

bait remains undisturbed. Once you see signs of feeding on the bait, refill the bait and set the traps.

Alternatively, pre-bait the traps with a large piece of peanut butter, hot dog, liver, or fruit. When you are ready to set the traps, remove the large piece of bait and smear a small bit on the underside of the trigger. The animals will have become used to taking the bait from the trigger and will now try to manipulate the trigger to find the bait they know should be there. Cereal (like oatmeal) can be sprinkled around the traps to make them more attractive. Remember that you will probably have to experiment to find the bait that works best in your situation.

Number of Traps to Use

It is difficult to give a formula for the number of traps to use because the appropriate number will depend on the situation; however, it is better to err on the side of too many traps than too few. Place traps where you see activity and try using traps every two to three feet along a wall. You may need three to six traps around each hole or burrow opening.

Concentrate the traps in one area at a time. When you have finished trapping in that area, move the traps to your next target.

Biological Controls

Some institutions maintain cats for protection against rats. Cats can “prune” a rat population but seldom eliminate it. They can be a deterrent to new rat immigration, although it is entirely possible to have alert cats and still have rats present. Owls and snakes are rat predators, so when considering the use of chemical control techniques, remember that depending on the toxicant used, these predators can be killed by consuming poisoned rats.

Chemical Controls

If non-chemical methods alone prove insufficient to solve the problem, then integrating a rodenticide into your management program may be warranted. Consult your local county office of the University of California Cooperative Extension for advice about the use of particular chemicals. They specialize in helping people with questions about pest problems. You can find your county office in the phone book or online at <http://danr.ucop.edu/regional.htm>. You can search for specific registered products in the DPR product and label database at <http://www.cdpr.ca.gov/>

Rodenticides must be used in accordance with their U.S. EPA-approved label directions. Applicators of restricted use materials must be certified to apply pesticides. Pesticide applicators should always wear protective gear during applications. All labels and Material Safety Data Sheets (MSDS) for the pesticide products authorized for use in the IPM program should be maintained on file. Do not apply these materials when buildings are occupied, and never apply them where they might wash into the sanitary sewer or into outside storm drains.

A pesticide product deployed in the form of a self-contained bait or trap is exempt from the posting and notification requirements of the Healthy Schools Act. Baits and bait stations will be avoided by the rats for a few hours to several days after initial placement. Even after this period, rats will be very cautious about approaching them. If a rat nibbles on a bit of poison bait that later makes it sick without killing it, the rat will avoid similar baits in the future, and, if female, may teach her young to do the same.

When to Use a Poison-Baiting Program

It is appropriate to use poison-baits when both trapping and physical changes to the building and to food and waste storage have been clearly documented to be ineffective. In emergency situations when there are very high numbers of rats or when rat fleas have been identified as transmitting bubonic plague, it may be appropriate to use poison baits, but trapping and habitat modification must also be used at the same time.

Be aware that overuse of some rodenticides has produced rat populations resistant to the poisons. Rodenticides should be used only if necessary. This approach preserves their effectiveness when they are needed to handle emergencies.

Instituting a Poison Baiting Program

Before beginning a baiting program, use monitoring blocks or stations (see the discussion under “Detection and Monitoring”, above) to determine the locations where rats are most likely to accept poison bait.

Points to remember when instituting a baiting program:

- Bait stations must always be secured in place and clearly labeled “RAT BAIT-POISON-DO NOT TOUCH.”
- Set out bait stations only where rats are most active and have previously gnawed on monitoring blocks.
- Place bait stations along walls and between shelter and the source of food. In the case of roof rats, bait stations should be placed above the ground in areas such as attics, roofs, or trees.
- For rats, bait stations should be placed 15 to 30 feet apart.

- Mark the location of each bait station on your building map.
- Check each bait station daily to make sure there is enough bait (this is extremely important), the bait is in good condition (not moldy or rancid), and the bait station is not being tampered with.
- Leave bait stations in place for the number of days recommended on the label. It may take four or more days for the rats to try the bait.
- Multi-dose anticoagulants take from four to nine days to kill rats if the bait is the only food source.
- Rats have an excellent sense of taste, enabling them to detect extremely small amounts of rat poison very quickly. For this reason, poisoned baits must be more attractive to rats than the other foods that are available to them in the area.
- Remove and securely store all bait stations when the baiting program is over.

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